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(71) Applicant
Bridgestone Tire
Company Limited
10-1 Kyobashi 1-chome
Chuo-ku
Tokyo
Japan
(72) Inventors
Hikaru Tansei
Kenichi Motomura
(74) Agents
Messrs J A Kemp & Co
14 South Square
Grays Inn
London WC1R 5EU

(54) Crown reinforcements

(57) A pneumatic tire has a crown reinforcement consisting of a main belt 24 which is formed of two or more plies 24*a,b,c* with cords at less than 30° to the equatorial plane E and which has an overall width W*a* approximately equal to the tread with W*t*, a ply 26 with cords at less than 30° to the plane E which is located between the tire carcass 20 and the main belt 24 and which has a width W*r* of 40–60% W*a*, and a ply 28 with cords at more than 45° to the plane E which is superposed on the main belt 24 and which has a width W*c* of 40–90% W*a*, the cord fabric of the ply 28 as a whole having a modulus of elasticity less than that of the cord fabric of the ply 26. Th modulus of the cords *per se* of the ply 28 may be smaller than that of the cords of all the remaining plies and/or the "void ratios" (as defined in the specification) of the ply 28 as a whole and its cords *per se* may be greater than in the re-maining plies.

FIG. 1

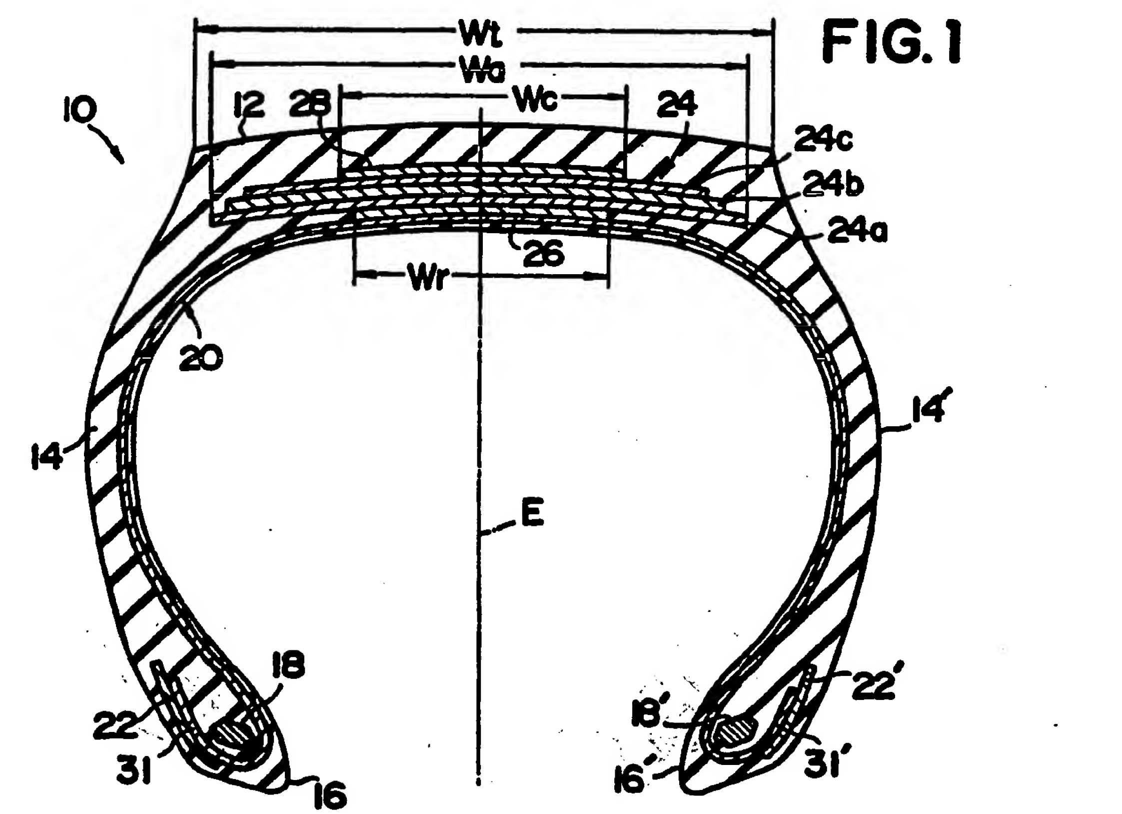

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FIG. 1

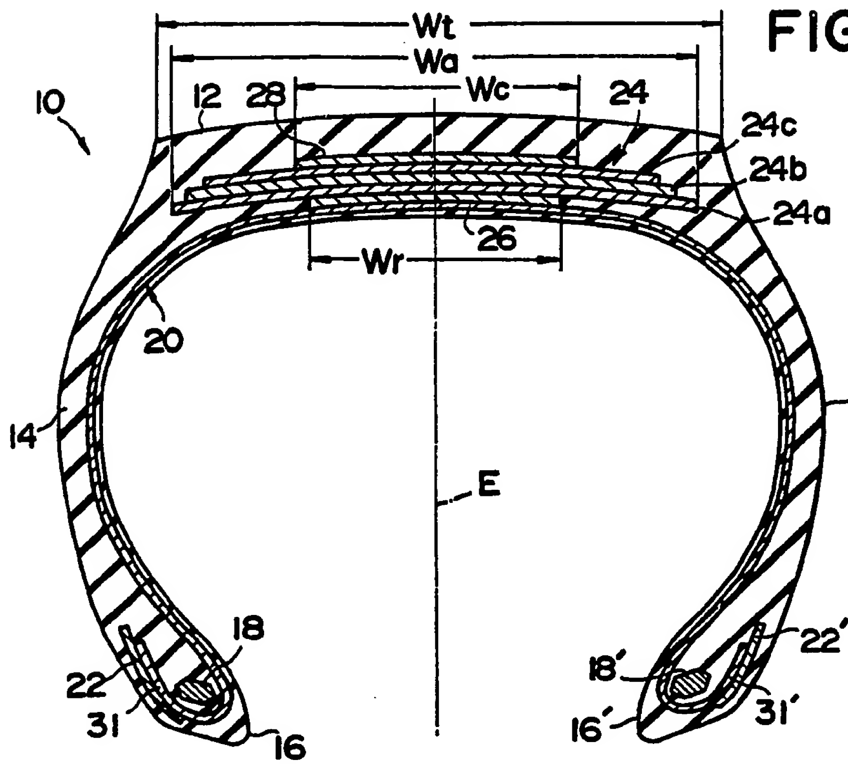
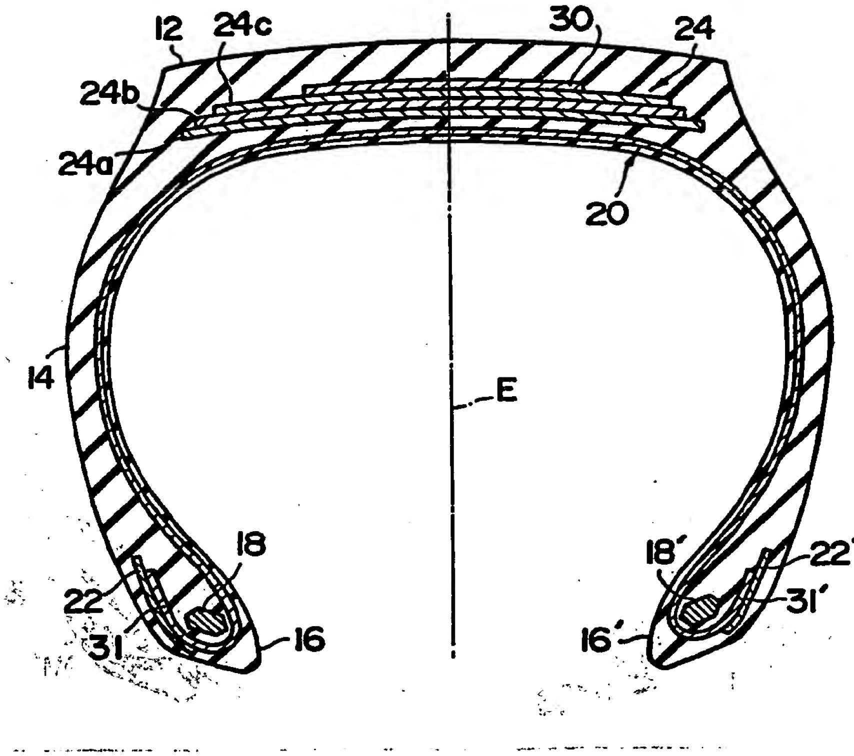


FIG. 2

PRIOR ART



SPECIFICATION

A pneumatic tire structur

The present invention relates to pneumatic tire structures for wheeled vehicles, particularly heavy-duty land vehicles such as buses and trucks.

A conventional radial tire structure has a tire carcass which is curved with a relatively small radius of curvature in a tread portion of the tire body. When such a tire structure is inflated with air under pressure or is used under varying load conditions, the belts embedded in the tire body are subjected to localized loads particularly in the vicinity of the equatorial plane of the tire body. The localized loads impair the dimensional stability of the belts and may cause destruction of the belts in the tire body.

If, on the other hand, the belts in the tire body of a radial tire structure are of the type using cords fabrics composed of rubber-coated cords of steel wires, the tire body has maximum stiffness in its tread portion so that the tread portion and the belts in the tire body are liable to produce cuts and cracks therein due to, for example, pebbles lodged in the tread portion of the tire body. Once cuts and cracks are thus produced in the tread portion and the belts, moisture is allowed to reach the belts in the tire body and cause corrosion of the steel cords or the belts, ultimately destroying the cord fabrics of the belts.

The present invention contemplates elimination of these problems through provision of an improved tire structure which features, *inter alia*, a tire body having a tread portion reinforced effectively in the neighborhood of the equatorial plane of the tire body and further arranged to provide an enhanced cut resistance.

In accordance with the present invention, there is proposed a pneumatic tire structure which comprises a tire body including an annular tread portion having a predetermined width and a pair of side wall portions radially extending inwardly from the tread portion, an annular tire carcass embedded in the tire body and composed of at least one ply of a rubber-coated cord fabric annularly extending throughout the circumference of the tire body and including an intermediate crown portion embedded in the tread portion of the tire body, an annular main belt embedded in the tread portion of the tire body and substantially coaxially surrounding the int rmediate crown portion of the tire carcass, the annular main belt having an v rall width approximately equal to the width of the tread portion of the tire body and comprising at least two pli s including a radially innermost ply and a radially uterm st ply, each f the plies consisting of a cord fabric composed of rubber-coat d cords extending at angles of less than 30 degrees with respect to a circumferential direction of the tire body, an annular reinforcement belt mbedded in the tread portion of the tire body and annularly extending between the annular main belt and the intermediate crown portion of the tire carcass, the reinforcement belt having a width within the range of between about 40 per cent and about 60 per cent of said overall width of the annular main belt and comprising a cord fabric composed of rubber-coated cords extending at angles of less than 30 degrees with respect to the circumferential direction of the tire body, the cord fabric of the reinforcement belt having a predetermined modulus of elasticity in its entirely, and an annular cusion belt embedded in the tread portion of said tire body and substantially coaxially surrounding the annular main belt, the cusion belt having a width within the range of between about 40 per cent and about 90 per cent of the overall width of the annular main belt and comprising at least one cord fabric composed of rubber-coated cords extending at angles of more than 45 degrees with respect to the circumferential direction of the tire body, the cord fabric of the cushion belt as a whole having a modulus of elasticity smaller than the modulus of elasticity of the cord fabric of said reinforcement belt.

In the accompanting drawings:

Figure 1 is a cross sectional view of a portion of a pneumatic tire structure embodying the present invention; and

Figure 2 is a view similar to Fig. 1 but shows a representative example of a prior-art pneumatic tire structure.

Referring to Fig. 1 of the drawing, a pneumatic tire structure proposed by the present invention comprises a rubber tire body 10 which consists essentially of an annular tread portion 12, a pair of side wall portions 14 and 14′ radially extending inwardly from the opposite axial ends or "shoulders", respectively, of the tread portion 12, and a pair of inner peripheral end portions respectively constituting bead portions 16 and 16′ radially merging inwardly from the side wall portions 14 and 14′, respectively. The bead portions 16 and 16′ of the tire body 10 define a pair of radially inner circumferential ends of the tire body 10. The tire body 10 in its entirety has a center axis (not shown) about which the above mentioned thread portion 12, side wall portions 14 and 14′ and bead portions 16 and 16′ are substantially coaxial with respect to one an ther. Furthermore, the tire body 10 as a whol has an equatorial plan E substantially p rpendicular to the center axis of the tire body 10 and axially extends in opposite directi ns from and substantially symmetrically with respect to th equitorial plane E. The tire structure further comprises bead cores 18 and 18′ which are embedded in the bead porti ns 16 and 16′, r spectively, of the

tire body 10. Each of the bead cores 18 and 18' is composed of strands of rubber-coated wires and circumferentially extends throughout the circumferential extent of each of the bead portions 16 and 16' of the tire body 10.

The tire body 10 has further embedded therein and annular tire carcass 20 which is composed of at least one ply of a rubber-coated or rubber-impregnated cord fabric. The tire carcass 20 extends circumferentially throughout the circumferential extent of the tire body 10 and, thus, annularly extends substantially in coaxial relationship to the tire body 10. Furthermore, the tire carcass 20 has an intermediate crown portion embedded in and extending axially throughout the tread portion 12 of the tire body 10 and a pair of side portions embedded in and radially extending throughout the side wall portions 14 and 14', respectively, of the tire body 10. The tire carcass 20 further has a pair of inner peripheral end portions embedded in the bead portions 16 and 16', respectively of the tire body 10. Each of these inner peripheral end portions of the tire carcass 20 is turned back axially and radially outward in such a manner as to have each of the bead cores 18 wrapped therein. The cord fabric or each of the cord fabrics constituting the tire carcass 20 is composed of rubberized parallel cords of, for example, steel wires or organic fibrous yarns which are coated or impregnated with rubber, as is well known in the art. The individual cords of the steel wires or fibrous yarns thus constituting the cord fabric or each of the cord fabrics of the tire carcass 20 are spaced apart in parallel from each other and are preferably arranged in such a nanner as to extend either in planes including the rotary axis of the tire body 10 or in planes which are slightly angled to the planes including the rotary axis of the tire body 10, though not shown in the drawings. In Fig. 1 of the drawings, the tire carcass 20 is shown, by way of example, as consisting of a single ply of such a cord fabric.

In Fig. 1 of the drawings, furthermore, the turned-back inner peripheral end portions 31 and 31' of the tire carcass 20 are shown reinforced by the layers of the chafers 22 and 22', respectively. Each of the chafer layers 22 and 22' is attached to the outer surface of each of the turned-back inner peripheral end portions 31 and 31' of the tire carcass 20 throughout the circumferential extent of the carcass 20 and is constituted by a rubber-coated cord fabric composed of parallel cords of, for example, steel wires which are coated with rubber. The cords of the steel wires of each of the chafer layers 22 and 22' are spaced apart in parallel from each other and are preferably arranged in such a manner as to extend in directions to cross the cords of the portions 31 and 31' of the carcass 20 which is in contact with the chafer layer, though not shown in the drawings.

The tire structure embodying the present invention further comprises an annular main belt 24 embedded in the tread portion 12 of the tire body 10 and coaxially surrounding the intermediate crown portion of the tire carcass 20. The annular main belt 24 is composed of two or more plies which are shown, by way of example, as consisting of three plies 24*a*, 24*b* and 24*c* which are superposed on each other radially of the tire body 10 and which annularly extend throughout the circumferential extent of the tire body 10. The annular main belt 24 thus constructed and arranged is effective to provide stiffness and machanical strength to the tire body 10.

Each of the component plies 24*a*, 24*b* and 24*c* of the annular main belt 24 is constituted by a rubber-coated cord fabric of parallel cords of, preferably, steel wires which are coated with rubber. The individual cords of the steel wires thus constituting the cord fabric of each of the plies 24*a*, 24*b* and 24*c* are spaced apart in parallel from each other and are arranged in such a manner as to extend at angles of less than 30 degrees with respect to the circumferential direction of the tire body 10 or, in other words, to the previously mentioned equatorial plane E of the tire body 10. The arrangements of the cords in the respective cord fabrics of the plies 24*a*, 24*b* and 24*c* are further preferably such that the cords in the cord fabric of each of the plies 24*a*, 24*b* and 24*c* extend in crossing relationship to the cords in the cord fabric of each of the other plies.

Each of the plies 24*a*, 24*b* and 24*c* of the annular main belt 24 preferably has its axially central circumference located on the equatorial plane E of the tire body 10 and axially extends in opposite directions from and substantially symmetrically with respect to the equatorial plane E. Furthermore, the individual plies 24*a*, 24*b* and 24*c* of the annular main belt 24 have different widths in the axial direction of the tire structure. As will be clearly seen from the illustration of Fig. 1, these widths of the plies 24*a*, 24*b* and 24*c* are smaller radially outwardly in the tread portion 12 of the tire body 10 so that the radially innermost ply 24*a* of the annular main belt 24 has the largest width and the radially innermost ply 24*c* of the main belt 24 has the smallest width. In this instance, it is preferable that the width (represented by W*a* in Fig. 1) of the broadest innermost ply 24*a* is approximately equal to the width (indicated by W*t*) of the tread portion 12 of the tire body 10. The innermost ply 24*a* and accordingly the main annular belt 24 as a whole are radially spaced apart outwardly from the intermediate crown portion of the tire carcass 20.

The tire structure embodying the present invention further comprises an annular reinforcement belt 26 which is embedded in the

tread portion 12 of the tire body 10 so as to add to the stiffness and strength provided by th annular main belt 24. The reinforcement belt 26 in closely interposed between the intermediate crown portion of the tire carcass 20 and the radially innermost ply 24*a* of the annular main belt 24 and annularly extends throughout the circumferential extent of the tire body 10. The reinforcement belt 26 is constituted by a single ply of a rubber-coated cord fabric composed of parallel cords of, for example, steel wires which are coated with rubber. If desired, a cord fabric composed of rubber-coated or rubber-impregnated fibrous yarns which are substantially as elastic as steel wires may be used as an alternative of the cord fabric of steel wires for forming the reinforcement belt 26.

The rubberized cords of the cord fabric constituting the reinforcement belt 26 are spaced apart in parallel from each other and are arranged in such a manner as to extend in directions generally identical with the direction in which the cords in the cord fabric of the innermost ply 24*a* of the annular main belt 24 extend. The cords in the cord fabric of the reinfocement belt 26 extend at angles of less than 30 degrees or preferably at angles between about 10 degrees and about 25 degrees with respect to the circumferential direction of the tire body 10 or to the equatorial plane E of the tire body 10. The arrangement of the cords in the cord fabric of the reinforcement belt 26 is further preferably such that the angles at which these cords extend with respect to the equatorial plane E of the tire body 10 are smaller than the angles (which are prefably smaller than 30 degrees as previously mentioned) at which the cords in the cord fabric of the innermost ply 24*a* of the annular main belt 24 extend with respect to the equatorial plane E. If the cords in the cord fabric of the reinforcement belt 26 extend at angles larger than 30 degrees with respect to the equatorial plane E of the tire body 10, there results a significant decrease in the efficiency at which the reinforcement belt 26 is capable of adding to the stiffness and strength of the annular main belt 24. The cords of the steel wires of organic fibrous yarns thus making up the cord fabric of the reinforcement belt 26 are preferably selected so that each of the cords is larger in modulus of elasticity than each of the cords of steel wires constituting the cord fabric of the innermost ply 24*a* of the annular main belt 24.

The reinforcement belt 26 constituted by the cord fabric thus arranged has its axially central circumference located on the equatorial plane E f the tire body 10 and axially extends in opposite directions from and substantially in symmetry with respect to th equatorial plane E. The reinforcement belt 26 has a width (indicated by *Wr* in Fig. 1) which in smaller than the overall width f the annular main belt 24 as shown and which is within the range of about 40% and about 60% of the width of the broadest one of the plies constituting the annular main belt 24 or, in the embodiment herein shown, the width *Wa* of the innermost ply 24*a* of the annular main belt 24. If the width *Wr* of the reinforcement belt 26 is less than about 40% of the overall width of the annular main belt 24, the reinforcement belt 26 is not capable of sufficiently adding to the stiffness and strength of the tire body 10. If, conversely, the width *Wr* of the reinforcement belt 26 is in excess of about 60% of the overall width of the annular main belt 24, the reinforcement belt 26 is unable to sufficiently add to the stiffness of the tread portion 12 of the tire body 10, particularly in the neighborhood of the equatorial plane E of the tire body 10. The overall width of the main belt 24 is intended in th present invention to mean a maximum width measured among the plies constituting the main belt 24.

The provision of the reinforcement belt 26 in combination with the annular main belt 24 in the tire body 10 is conducive to prevention of unusual and excessive deformation of the tire structure and particularly to enhancement of the stiffness of the tread portion 12 of the tire body 10. If the increase in the stiffness of the tread portion 12 of the tire body 10 is excessive, the tread portion 12 will becom liable to produce cuts and cracks therein during travelling of an automotive vehicle using the tire structure.

For the purpose of precluding such a problem, the tire structure proposed by the present invention further comprises an annular cushion belt 28 embedded in the tread portion 12 of the tire body 10. The cushion belt 28 is provided in coaxially encircling relationship to the annular main belt 24 and is shown, by way of example, as being closely attached to the outer peripheral surface of the radially outermost ply 24*c* of the annular main belt 24. The cushion belt 28 thus annularly extends throughout the circumferential extent of the tire body 10 and is constituted by a suitable number of plies of rubber-coated cord fabric composed of parallel cords of, preferably, steel wires which are coated with rubber. In the embodiment shown in Fig. 1, the cushion belt 28 is assumed, by way of example, as being composed of a single ply of such a cord fabric.

The rubberized cords of the cord fabric constituting the cushion belt 28 are spac d apart in parallel from each oth r and are arranged in such a mann r as t xt nd at angles larger than 45 degrees or, pr f rably, at angles between about 55 degrees and about 70 degrees with respect to the circumferential direction f th tire body 10 or to the equatorial plane E of the tire body 10. If th cords in the cord fabric of the cushion belt 28

are arranged to extend at angles less than 45 degrees with respect the the equatorial plane E of the tire body 10, the cushion belt 28 is unable to provide a sufficient cushioning effect and can not prevent the tire body 10 from cuts and cracks in its tread portion 12 during cruising of an automotive vehicle using the tire structure. The cords in the cord fabric of the cushion belt 28 may be arranged to extend in crossing relationship to the radially outer ply 24*c* of the annular main belt 24 but are preferably arranged in such a manner as to extend in directions which are generally identical with the directions in which the cords in the cord fabric of the outermost ply 24*c* of the main belt 24 extend. Furthermore, each of the cords constituting the cord fabric of the cushion belt 28 is constructed by individual filaments or any line elements preferably in such a manner as to be larger in void ratio than each of the cords in the cord fabric of one of the plies 24*a*, 24*b* and 24*c*, particularly the cord fabric of the radially outermost ply 24*c*, of the annular main belt 24. The "void ratio" herein referred to in connection with a cord is defined as the ratio of the difference (Sa–Sb) between the cross-sectional area Sa formed by a circle contactingly surrounding the outermost line elements or filaments constituting a cord and the sum Sb of the respective cross sectional areas of the individual line elements or filaments of the cord *versus* the envelope area Sa and is hence written as $(Sa-Sb)/Sa$. Preferably, each of the cords in the cord fabric of the cushion belt 28 is larger in void ratio than each of the cords constituting each of the plies 24*a*, 24*b*, 24*c* of the annular main belt 24 and further than each of the cords constituting the cord fabric of the reinforcement belt 26.

The cushion belt 28 made up of the cord fabric thus arranged has its axially central circumference located on the equatorial plane E of the tire body 10 and axially extends in opposite directions from and substantially in symmetry with respect to the equatorial plane E. The cushion belt 28 has a width (indicated by Wc in Fig. 1) which is smaller than the overall width of the annular main belt 24 as shown and which is preferably within the range of about 40% and about 90% of the width of the broadest one of the plies constituting the annular main belt 24 or, in the embodiment herein shown, the width Wa of the radially innermost ply 24*a* of the annular main belt 24. If the width Wc of the cushion belt 28 is less than about 40% of the overall width of the annular main belt 24, the cushion belt 28 could not compensate for the i[illegible]ment of the stiffness of the tread portion [illegible] of the tire body 10 stiffened by reinforcement belt 26. If, conversely, the width Wc of the cushion belt 28 is larger than about 90% of the overall width of the annular main belt 24, then the cushion belt 28 would cause [illegible] excessive generation of heat in the tire body 10 when the tire structure is in use. For these reasons, the width Wc of the cushion belt 28 is substantially equal to or slightly larger than the width Wr of the reinforcement belt 26.

Furthermore, the cushion belt 28 as a whole has a modulus of elasticity smaller than the modulus of elasticity of the reinforcement belt 26 as a whole. It is further preferred that the cord fabric constituting the cushion belt 28 is smaller in void ratio than the cord fabric of the reinforcement belt 26 and the cord fabric constituting each of the plies 24*a*, 24*b* and 24*c* of the annular main belt 24. The "void ratio" herein referred to in connection with a cord fabric is defined as the ratio of the difference (Sc–Sd) between the cross sectional area Sc of a cord fabric and the sum Sd of th respective cross sectional areas of the cords constituting the cord fabric *versus* the cross sectional area Sc of the cord fabric and is thuswritten as $(Sc-Sd)/Sc$. The cord of the cushion belt 28 has a modulus of elasticity preferably smaller than that of the cord of the reinforcement belt 26 and that of the cord of the outermost ply 24*c* of the main belt 24.

COMPARISON WITH PRIOR ART

To compare a tire structure proposed by the present invention with a prior-art tire structure for some performance characteristics, a specimen of the tire structure constructed generally as hereinbefore described was prepared and tested for the growth rate, the susceptivity to cut, the moisture trap characteristics, the corrosiveness of the steel cords and so on.

The specimen used for these tests was a tire structure measuring 11 inches in width, 22.5 inches in inside diameter, that is, the tire of 11R 22.5 and 0.9 in flatness factor.

The carcass 20 of the specimen tire structure was constituted by parallel cords of rubber-coated steel wires embedded in the tire body 10 of rubber.

The annular main belt 24 of the specimen tire structure was made up of three plies 24*a*, 24*b* and 24*c* each consisting of a cord fabric composed of rubber-coated cords of steel wires. The cords in the cord fabric of each of the three plies 24*a*, 24*b* and 24*c* were arranged to extend at the angles of about 15 degrees with respect to the equatorial plane E of the tire body 10. The arrangements of the cords in the cord fabrics of the three plies were further such that the cords in the cord fabric of the innermost ply 24*a* extended substantially in parallel with the cords in the cord fabric of the outermost ply 24*c* while the cords in the cord fabric of the intermediate ply 24*b* extended in crossing relationship to the cords of the cord fabric of each of the innermost and outermost plies 24*a* and 24*b*. The cords of the respective cord fabrics of the individual plies 24*a*, 24*b* and 24*c* of the annular main belt 24 were further such that

all the cord fabrics has appoximately equal void ratios. Furthermore, the cords of the cord fabrics constituting the three plies had substantially equal void rations and moduli of elasticity.

The reinforcement belt 26 of the specimen tire structure was constituted by a cord fabric composed of rubber-coated cords arranged to extend in directions generally identical with the longitudinal directions of the cords in the cord fabric of the innermost ply 24*a* of the annular nain belt 24 and at the angles of about 10 degrees with respect to the equatorial plane E of the tire body 10. The width W*r* of the reinforcement belt 26 was about 50% of the width W*a* of the innermost ply 24*a* of the annular main belt 24, the width of the particular ply being approximately equal to the width W*t* of the tread portion 12 of the tire body 10.

The cushion belt 28 of the tire structure prepared as the specimen was constituted by a cord fabric composed of rubber-coated cords arranged to extend in directions generally identical with the longitudinal directions of the cords in the cord fabric of the outermost ply 24*c* of the annular belt 24 and at the angles of about 60 degrees with respect to the equatorial plane E of the tire body 10. The arrangement of the cords in the cord fabric of the cushion belt 28 was further such that the cord fabric had a void ratio which was equal to about 1.3 times the void ratio of the cord fabric of each ply of the annular main belt 24 and the void ratio of the cord fabric of the reinforcement belt 26. Furthermore, each of the cords in the cord fabric of the cushion belt 28 had a void ratio equal to about 1.15 times the void ratio of each of the cords in the cord fabric of each ply of the annular main belt 24 and the void ratio of each of the cords fabric of the reinforcement belt 26 and a modulus of elasticity which was equal to about 0.6 times the modulus of elasticity of each of the cords in the cord fabric of each ply of the annular main belt 24 and the modulus of elasticity of each of the cords in the cord fabric of the reinforcement belt 26.

The construction of the prior-art tire structure with which the specimen tire structure thus constructed and arranged was generally such that is illustrated in Fig. 2 of the drawings. The prior-art tire structure was thus composed of a tire body 10, a pair of bead cores 18 and 18′, a tire carcass 20, a pair of chafer layers 22 and 22′ and an annular main belt 24. These component members f the prior-art tire structure were constructed gen r-ally similarly to their respective counterparts in the tire structure illustrated in Fig. 1 of the drawings and were further arranged and dimensioned similarly to their respective coun-t rparts of the abov described specimen tire structure. In the prior-art tire structure, an annular protective belt 30 was additionally provided, which was embedded in the tread portion 12 of the tire body 10 and which was attached to the outer peripheral surface of the outermost ply 24*c* of the annular main belt 24 as shown. The protective belt 30 was constituted by a cord fabric of rubber-coated cords of steel wires which were arranged to extend at the angles of 15 degrees with respect to the equatorial plane E of the tire body 10. The cords in the cord fabric of the protective belt 30 were further arranged so that the cord fabric composed thereof was substantially equal in modulus of elasticity to the cord fabric of each ply of the annular main belt 24.

Tests were conducted with the specimen tire structure and the prior-art tire structure for the growth rates of the tire structures, the susceptivity to cut of the belts, the moistur trap characteristics of the belts, and the corrosiveness of the steel cords in the belts. The tests for the growth rates were conducted under conditions in which each of the tire structures inflated with the internal pressure of 7.25 kgs/cm^2 on a wheel rim was subjected to the load of 2,425 kgs on a road surface and driven for rotation at the circumferential speed of 75km/hr. on the road surface. The susceptivity of cut of the belts was measured by counting the number of cuts in the belt of the tire structure tested. The following table shows the results of these tests in terms of index numbers using the tests results of the prior-art tire structure as the bases.

	Prior-Art	Specimen
Growth Rate	100	68
Susceptivity to cut	100	85
Moisture Trapping	100	60
Corrosiveness	100	Below 50

CLAIMS

1. A pneumatic tire structure comprising

a tire body including an annular tread portion having a predetermined width and a pair of side wall portions radially extending inwardly from said tread portion,

an annular radial tire carcass embedded in the tire body and composed of at least one ply of a rubber-coated cord fabric annularly ext nding throughout the circumference f th tire body and including an intermediate crown porti n embedded in the tread portion of the tire body,

an annular main b lt embedded in the tread portion of th tire body and substantially coaxially surrounding the intermediate cr wn portion f th tire carcass, the annular main b lt having an overall width approximately

qual to the width of the tread portion of said tire body and comprising at least two plies including a radially innermost ply and radially outermost ply, each of said plies consisting of a cord fabric composed of rubber-coated cords extending at angles of less than 30 degrees with respect to a circumferential direction of the tire body,

an annular reinforcement belt embedded in the tread portion of the tire body and annularly extending between said annular main belt and the intermediate crown portion of said tire carcass, the reinforcement belt having a width within the range of between about 40 per cent and about 60 per cent of said overall width of said annular main belt and comprising a cord fabric composed of rubber-coated cords extending at angles of less than 30 degrees with respect to the circumferential direction of the tire body, the cord fabric of the reinforcement belt having a predetermined modulus of elasticity in its entirety, and

an annular cushion belt embedded in the tread portion of said tire body and substantially coaxially surrounding said annular main belt, the cushion belt having a width within the range of between about 40 per cent and about 90 per cent of said overall width of said annular main belt and comprising at least one cord fabric composed of rubber-coated cords extending at angles of more than 45 degrees with respect to the circumferential direction of said tire body, the cord fabric of the cushion belt as a whole having a modulus of elasticity smaller than the modulus of elasticity of the cord fabric of said reinforcement belt.

2. A pneumatic tire structure as set forth in claim 1, in which the cord fabric of said cushion belt is larger in void ratio than the cord fabric of said outermost ply of said annular main belt.

3. A pneumatic tire structure as set forth in claim 1, in which the cord fabric of said cushion belt is larger in void ratio than the cord fabric of each of said plies of said annular main belt.

4. A pneumatic tire structure as set forth in any one of clains 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said outermost ply of said annular main belt.

5. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of each of the plies of said annular main belt.

6. A pneumatic tire structure as set forth in claim 5, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt.

7. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt as a whole.

8. A pneumatic tire structure as set forth in claim 7, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt.

9. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt and in which each of the cords in the cord fabric of the cushion belt is larger in void ratio than each of the cords of the cord fabric of each of said plies of said annular main belt.

10. A pneumatic tire structure as set forth in claim 9, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt.

11. A pneumtic tire structure as set forth in any one of claims 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is smaller in modulus of elasticity than each of the cords in the cord fabric of the outermost ply of said annular main belt and each of the cords in the cord fabric of said reinforcement belt.

12. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is smaller in modulus of elasticity than each of the cords in the cord fabric of each of said plies of said annular main belt and each of the cords in the cord fabric of said reinforcement belt.

13. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is smaller in modulus of elasticity than each of the cords ir the cord fabric of said outermost ply of said annular main belt and each of the cords in the cord fabric of said reinforcement belt and is larger in void ratio than each of the cords in the cord fabric of said outermost ply of the annular main belt.

14. A pneumatic tire structure as set forth in claim 13, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt.

15. A pneumatic tire structure as set forth in claim 13, in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt.

16. A pneumatic tire structure as set forth in claim 13, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt and in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt.

17. A pneumatic tire structure as set forth in any one of claims 1, 2 and 3, in which each of the cords in the cord fabric of said cushion belt is smaller in modulus of elasticity than each of the cords in the cord fabric of each of said plies of said annular main belt and each of the cords in the cord fabric of said reinforcement belt and is larger in void ratio than each of the cords in the cord fabric of each of the plies of the main belt.

18. A pneumatic tire structure as set forth in claim 17, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt.

19. A pneumatic tire structure as set forth in claim 17, in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt.

20. A pneumatic tire structure as set forth in claim 17, in which each of the cords in the cord fabric of said cushion belt is larger in void ratio than each of the cords in the cord fabric of said reinforcement belt and in which the cord fabric of said cushion belt as a whole is larger in void ratio than the cord fabric of said reinforcement belt.

21. A pneumatic tire structure as set forth in claim 1, in which in the cords in the cord fabric of said cushion belt extend in directions generally identical with the directions in which the cords in the outermost ply of said annular main belt extend.

22. A pneumatic tire structure as set forth in claim 1 or 21, in which the cords in the cord fabric of said cushion belt extend at angles within the range of between about 55 degrees and about 70 degrees with respect to the circumferential direction of said tire body.

23. A pneumatic tire structure as set forth in claim 1 or 20, in which the cords in the cord fabric of said reinforcement belt consist of steel wires and extend at angles smaller than the angles at which the cords in the innermost ply of said annular main belt extend with respect to the circumferential direction of said tire body.

24. A pneumatic tire structure as set forth in claim 1 or 21, in which the cords in the cord fabric of said reinforcement belt consist of steel wires and extend at angles within the range of between about 10 degrees and 25 degrees with respect to the circumferential direction of said tire body.

25. A pneumatic tire structure as set forth in claim 24, in which the cords in the cord fabric of said cushion belt extend at angles within the range of between about 55 degrees and about 70 degr es with respect to the circumferential direction f said tire body.

26. A pneumatic tire structur as set forth in claim 1, in which said plies of said annular main belt have diff rent widths.

27. A pneumatic tire structure as set forth in claim 26, in which said innermost ply of said annular main belt has said overall width of the main belt.

28. A pneumatic tire structure as set forth in claim 1, in which the cords in each of the plies of said annular main belt extend in crossing relationship to the cords in another ply of the annular main belt.

29. A pneumatic tire structure as set forth in claim 1, in which cord fabric of said reinforcement belt is larger in modulus of elasticity than the cord fabric of the innermost ply of said annular main belt.

30. A pneumatic tire structure as set forth in claim 1, in which said tire body has a center axis therethrough and an equatorial plane substantially perpendicular to said center axis and in which each of said tire body, said tire carcass, annular main belt, said reinforcement belt and said cushion belt extends in opposite directions from and substantially in symmetry with respect to said equatorial plane.

31. A pneumatic tire structure as set forth in claim 1, in which the cords of the cord fabric of said annular main belt consist of steel wires.

32. A pneumatic tire structure as set forth in claim 1, in which the cords of the cord fabric of said cushion belt consist of steel wires.

33. A pneumatic tire structure substantially as hereinbefore described with reference to and as illustrated in Fig. 1 of the accompanying drawings.

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